August 6, 2015

Target Industry Report

In support of the Nebraska Department of Economic Development's (DED) strategic planning and economic development ecosystem assessment, the NDED Research Division is providing this updated report of Nebraska's targeted industries. This report will identify Nebraska's targeted industries and related industry clusters, and provide data on these industries and industry groups. The targeted industry groups identified in the 2010 Battelle Technology Partnership Practice report, *Growing Jobs, Industries, and Talent: A Competitive Advantage Assessment and Strategy for Nebraska*, and will be reviewed and updated with data from 2008 through 2014—from the start of the Great Recession through the most current complete reporting year. Data used in this report are the most recent available data as of June 30, 2015.

The Battelle report identified over 240 primary industries that exist or could exist in Nebraska, based on the North American Industry Code System (NAICS). These industries were than combined into 12 primary industry clusters, and then provided measures of the performance of these industry groups in Nebraska from 2001 through 2007. The end date of 2007 was chosen to coincide with the end of the business cycle that began in 2001, with the trough occurring in November of that year [National Bureau of Economic Research, Business Cycle Dating Committee, 2012]. The approach taken in this report will be, whenever possible, to append data to that used in the Battelle report. Rather than omit the period of the Great Recession, from the US economy's peak in December 2007 through June 2009, when the US economy began its most recent recovery, this report will append the 2008-14 data to any revisions of the 2001-07 data used by Battelle. There may be a natural tendency to prefer to use a period of recovery from the end of one recession to the year of the next peak; however, there are some advantages to reporting how the state's industries fared through the entire business cycle. This is especially true as Nebraska appeared to have weathered the last recession better than most states.

Standard measures such as location quotients and shift-share analyses will be used to update the list of Nebraska's targeted industry groups, using Battelle's targeting analysis for prioritizing economic development efforts among industries in these industry groups.

This report will also include comparisons of Nebraska to other states in terms of such factors as industrial specialization, tax climates, population, cost of labor, measures of innovation, access to capital, and education programs. Finally, this report will provide a great deal of 50-state data for the purpose of comparing Nebraska's economic performance, and for the purpose of proposing a set of states for benchmarking Nebraska's future performance.

The NDED Research Division was not able to recreate all of the tables and metrics used by Battelle in their report. Most often this was due to Battelle's use of proprietary data, which NDED does not have access to. This inability to extend Battelle's work is greatest where the 2010 report used IMPLAN to model the value-added impacts of the industry clusters to Nebraska's economy. In most cases, alternative sources of data are available for extending the review through the current period.

Assessment of Nebraska's Primary Industry Groups

In 2010, the Battelle Technology Partnership Practice conducted a detailed assessment of the building blocks of Nebraska's economy, focusing on the position of the state's industry clusters, its innovation preparedness, and its talent development. This assessment involved in-depth quantitative analysis of a wide variety of data sources on Nebraska's industries, technology drivers, and talent base. Through this effort Battelle identified 12 primary industry clusters that drive Nebraska's economic growth.

The Battelle report focused on identifying primary industries – basic industries that support the export market, or alternatively, reduce the local demand for imported goods – rather than service industries that support local markets. Export meaning that the goods or services produced in Nebraska are sold outside Nebraska, either nationally or internationally. Supporting this approach, the Battelle report notes that "the most effective way to advance the economic development of primary industries is to focus on the industry clusters found within a state's economic base industries" [Battelle, 2010, p.8].

Twelve primary industry clusters were identified as drivers of economic growth in Nebraska. Because there is no standard list of industry clusters defined for all states, defining a set of industry clusters for Nebraska required a detailed analysis of industries found across the state that is focused on economic base activities, and then deciding how and where industries fit into a cluster. This was done in consultation with the Nebraska Department of Economic Development and an advisory committee made up of economic development stakeholders. From this process Battelle identified more than 240 detailed primary industries involved in economic base activities in Nebraska and organized them into the 12 primary industry clusters identified below. A complete list of industries is included in Battelle 2010 Appendix A.

Battelle's 2010 Nebraska Industry Clusters

Agricultural Machinery	Agriculture & Food Processing
Biosciences	Business Management & Administrative Services
Financial Services	Health Services
Hospitality & Tourism	Precision Metals Manufacturing
Renewable Energy	Research, Development, & Engineering Services
Software & Computer Services	Transportation, Warehousing, & Distribution Logistics

Battelle noted that even though health services are not normally viewed as an economic base activity, it is included in the list of industry clusters because "health services are widely considered a critical economic and workforce driver in regional economies across Nebraska, and serve to attract patients from neighboring states" [Battelle, 2010, p. 10]. Another of the Battelle clusters, renewable energy, was counted as a cluster, even though there was not enough activity in any industry other than ethanol production to measure.

Service industries are not typically viewed as an economic base activity, as they primarily consist of businesses that typically serve local Nebraska customers. Like retail stores, service industries are important for serving local needs and ensuring a high quality of life in the state. However, they are not considered to be wealth-creating sectors of the economy, as they typically do not result in additional exports nor do they reduce import costs for the state. In short, the report included health services cluster in their list of primary industry clusters because they "are widely considered a critical economic and workforce driver in regional economies across Nebraska and serve to attract patients from neighboring states, this sector was included as a primary industry driver" [Battelle, 2010, p. 10].

After identifying Nebraska's primary industry clusters, Battelle assessed the performance of the industry groups in terms of the concentration of the industry cluster in the state, employment, and economic output.

Relative concentration of an industry cluster is a measure of how specialized an industry cluster is in a specific region compared to the nation, and is an indication of the "competitive advantage" for the cluster relative to the nation. The measure of this specialization is the location quotient (LQ), which is found by dividing the proportion of a region's employment in an industry cluster by the same proportion on the national level. That is, $LQ_i = \frac{e_i}{e} / \frac{E_i}{E}$, where e_i is the regional employment in industry i, e is total employment in the region, E_i is national employment in industry i, and E is total employment at the national level. An LQ less than 1 indicates that the ratio of employment at the regional level is less than the ratio at the national level, which implies that the region is underrepresented in the industry. An LQ greater than 1 indicates a higher relative concentration of the industry locally, and "an LQ greater than or equal to 1.20 denotes an employment concentration significantly above the national average, and thus [the industry is] considered 'specialized'" [Battelle 2010, p. 10].

The other performance measures used by Battelle are more straightforward. The report looked at whether an industry cluster had gained or lost employment between years. The third metric used to assess performance is the relative employment growth of the local industry cluster compared with the growth of the same cluster at the national level between two time periods. The choice of time periods may be the most difficult part of the analysis. "It is best to compare changes in employment over an entire national business cycle (peak to peak) to ensure an 'apples to apples' comparison" [Battelle, 2010, p. 10].

For their performance assessment, the Battelle study compared data from 2001 and 2007, even though the 2008 data were available. The Battelle report's timing was fortuitous in terms of the ability to pick an entire business cycle. On December 1, 2008, the NBER's Business Cycle Dating Committee announced that the peak of the post-2001 expansion occurred in December 2007, and further, on September 20, 2010, the committee announced that the recession that began in January 2008 officially ended in June 2009; hence Battelle knew before they completed their work that the 2001 through 2007 period constituted a completed business cycle.

The current review does not have the benefit of that knowledge. While there are data available through 2014, it is unknown at this time when the current business cycle will end. Even taking the unofficial definition of a recession as two consecutive quarters of negative real Gross Domestic Product (GDP) growth, the negative growth reported in the first quarter 2015 does not necessarily mean that the US economy is in recession, nor does it provide a date for the end of the expansion that started in mid-2009. Even if 2015 should mark the end of the last expansion, it is unlikely that the NBER would officially date the end of the most recent business cycle anytime this year. Rather than attempt to compare industry data from one business cycle to industry data from another, possibly incomplete business cycle, NDED's Research Division chose to append the 2008–14 data to the 2001–07 data used by Battelle.

Another reason for using appended data, beyond not knowing the timing of the business cycle, is the relative severity of the 2008-09 recession. Of the 11 post-war US recessions, the most recent recession was the worst, both in terms of the length of the downturn and the depth of the decline in economic output of the US economy. The Great Recession lasted 18 months, and real GDP declined 4.2%, whereas the average post-war recession lasted 11.1 months and real GDP declined by 1.1% [NBER, BEA]. Nebraska's real GDP grew at an annual compounded rate of 2.3% from 2008 through 2014, the third fastest of all the states, and for the entire 2001–14 period, Nebraska's annual compounded growth rate was 2.4%, the seventh fastest of the states. This compares to 2.7% and a rank of 21st for the entire 2001–14 period. The two faster-growing states in the 2008–14 period, North Dakota and Texas, benefited significantly from growth in their energy sectors. The US economy grew at a 1.2% rate over the 2008–14 period, and six states still have negative annual growth rates five years after the end of the recession.

Given that Nebraska appeared to do better than most states during the recession, reviewing the performance of the state's primary industry groups over a long period, through the last complete business cycle to the present, may shed some light on why the Nebraska economy performed better than most other states. [BEA State GDP Comparison]. In addition, looking at the long series should not penalize those industry groups that tend to do poorly during recessions or reward those that tend to be recession-proof.

Employment-Based Trends and Target Assessment of Nebraska's Industry Clusters

The Battelle report found that between 2001 and 2007 the industry clusters identified in the report performed strongly in employment measures. A full three-quarters of the clusters fared well, based on employment criteria. Five of the 12 clusters were classified as current strengths, three were classified as emerging strengths or emerging opportunities, and the remaining four were classified as retention targets.

The employment-based target assessment criteria are based on three measures. The first is the location quotient, used to determine if the industry is specialized in Nebraska. Specialized industries have an LQ greater than or equal to 1.2. The second criterion is employment growth over the time span of the analysis. The third criterion is whether employment in the local industry grew faster or slower than the same industry at the national level.

Industry clusters that were specialized in Nebraska, and that generated additional employment in Nebraska between 2001 and 2007, and had rates of employment growth greater than the national growth rate for the same industry were classified as current strengths. The five industry clusters that met all three of the criteria were financial services; transportation, warehousing, and distribution logistics; precision metals manufacturing; biosciences; and renewable energy.

Next, industry clusters that were not specialized in Nebraska, but had increased employment locally, were classified as emerging strengths or emerging opportunities, depending upon their relative employment growth compared with national employment growth in those clusters. Battelle identified three clusters that met these criteria. "Of these three, R&D and engineering services stands out because it outpaced the national employment growth rate, while the other two—health services and hospitality and tourism—grew but below the national average" [Battelle, 2010, p.11].

Table 1. Nebraska Primary Industry Clusters, Target Assessment, Battelle 2010, page 12.

Industry	Degree of Specialization, 2008 (LQ)	NE Employment Change, 2001-07	US Employment Change, 2001-07	Competitive Share Gain or Loss, 2001-07 (% Pt. Change vs. US)	Target Assessment
Total Employment	**1.00**	**3.60%**	**4.30%**	**-0.7**	**N/A**
Agricultural Machinery	7.43	-4.4%	-4.6%	0.1	Retention
Agriculture & Food Processing	2.26	-4.8%	-4.3%	-0.5	Retention
Biosciences	1.21	20.6%	15.3%	5.3	Current Strength
Business Management & Administrative Services	1.22	6.3%	9.1%	-2.8	Retention
Financial Services	1.38	9.5%	6.4%	3.1	Current Strength
Health Services	1.01	8.0%	14.0%	-6	Emerging Opportunity
Hospitality & Tourism	0.84	1.0%	1.6%	-0.6	Emerging Opportunity

Precision Metals Manufacturing	1.15	4.6%	-10.2%	14.9	Current Strength
Research, Development, & Engineering Services	0.56	34.2%	5.5%	28.7	Emerging Strength
Software & Computer Services	1.14	-16.8%	1.3%	-17.5	Retention
Transportation, Warehousing, & Distribution Logistics	1.98	27.4%	3.3%	24.1	Current Strength
Renewable Energy (Biofuels)	28.45	547.2%	116.2%	431	Current Strength

Source: Battelle analysis of Bureau of Labor Statistics, QCEW data from IMPLAN. Note: Competitive Share changes calculated on unrounded numbers. LQ = Location Quotient.

Finally, four Nebraska primary industry clusters identified by Battelle, which were specialized but either did not increase Nebraska employment between 2001 and 2007 or grew Nebraska employment at a rate slower than the industry nationally, were identified as retention targets. Of these four clusters, only business management and administrative services enjoyed increased employment in Nebraska, and only one of the four enjoyed a greater rate of employment growth in Nebraska than nationally. The other two retention targets, agriculture and food processing, and software and computer services, lost employment and ended the 2001–2007 business cycle with slower employment growth in Nebraska than at the national level. The table below, reproduced from the 2010 Battelle report, provides the information used in Battelle's target assessment for Nebraska's primary industry clusters.

Table 2 presents employment levels and growth rates for Battelle's primary industry clusters for Nebraska and for the US for 2008 and 2014. The data for this time period represented in Table 2 will be appended to the original Battelle report. In addition, the Nebraska and US growth rates are shown for the 2008–2014 period.

For some of the clusters, there are some notable differences in employment growth trends between the time periods. For example, note that the rate of employment growth in the agricultural machinery cluster was negative for both Nebraska and the US as a whole between 2001 and 2007; however, employment in both areas was positive in the 2008–2014 period. Conversely, in the Financial Services and Business Management and Administrative Services clusters, Nebraska and US employment changed from positive for both areas in the early period to negative for both in the later period. Agriculture and Food Processing in Nebraska reversed a negative employment trend and started positive growth since the beginning of the recession. The US trend for this industry group remained negative in the later period, however. Some industry clusters that showed positive employment growth in the early period, both at the state and national level, retained this trend in the later period; these clusters included Health Services, Software and Computer Services, and Renewable Energy. The Research and Development cluster saw rapid growth in Nebraska in the early period, but saw the trend reverse in the later period.

Table 2. Employment Levels and Growth by Targeted Industry Group, 2008–2014

Target Industry Title	NE 2008	NE 2014	US 2008	US 2014	NE % Change 2008-14	U.S. % Change 2008-14
Total Employment	**766,991**	**786,782**	**113,188,643**	**115,557,595**	**2.6%**	**2.1%**
Agricultural Machinery	10,058	11,153	199,835	206,697	10.9%	3.4%
Agriculture & Food Processing	54,889	55,746	3,055,208	2,461,387	1.6%	-19.4%
Biosciences	7,500	5,950	1,244,361	1,695,204	-20.7%	36.2%
Business Management & Administrative Services	43,557	41,178	5,276,384	5,048,338	-5.5%	-4.3%
Financial Services	50,799	48,782	5,199,538	5,044,404	-4.0%	-3.0%
Health Services	56,509	59,428	8,019,696	8,804,768	5.2%	9.8%
Hospitality & Tourism	12,545	15,190	2,890,443	2,426,488	21.1%	-16.1%
Precision Metals Manufacturing	16,495	10,484	2,111,649	1,501,099	-36.4%	-28.9%
Research, Development, & Engineering Services	6,213	5,765	1,078,876	1,614,488	-7.2%	49.6%
Software & Computer Services	15,244	16,748	1,966,971	2,374,820	9.9%	20.7%
Transportation, Warehousing, & Distribution Logistics	38,077	36,933	3,671,257	3,574,590	-3.0%	-2.6%
Renewable Energy (Biofuels)	1,770	1,884	9,182	10,582	6.4%	15.2%

Source: Data from BLS, QCEW, 2015; Calculations by NDED, 2015
Note: Employment is from published BLS data, which may not be complete for Nebraska. In the case of incomplete data, US employment for that industry is dropped, to provide consistent results.

Table 3 presents employment levels and growth rates for Battelle's primary industry clusters for Nebraska and for the US for 2008 and 2014. In addition, the Nebraska and US growth rates are shown for the 2008–2014 period.

Table 3. Employment Levels and Growth by Targeted Industry Group, 2001–2014

Target Industry Title	NE 2001	NE 2014	US 2001	US 2014	NE % Change 2001-14	US % Change 2001-14
Total Employment	**735,492**	**786,782**	**109,304,802**	**115,557,595**	**7.0%**	**5.7%**
Agricultural Machinery	9,762	11,153	207,292	206,697	14.2%	-0.3%
Agriculture & Food Processing	55,484	55,746	3,096,356	2,461,387	0.5%	-20.5%
Biosciences	5,143	5,950	805,222	1,454,514	15.7%	80.6%
Business Management & Administrative Services	38,245	41,178	4,498,429	5,048,338	7.7%	12.2%
Financial Services	44,406	48,782	5,008,173	5,044,404	9.9%	0.7%
Health Services	51,462	59,428	6,877,555	8,804,768	15.5%	28.0%
Hospitality & Tourism	14,687	15,190	2,239,602	2,426,488	3.4%	8.3%

Precision Metals Manufacturing	16,081	10,484	2,462,129	1,468,803	-34.8%	-40.3%
Research, Development, & Engineering Services	4,532	5,765	1,401,954	1,614,488	27.2%	15.2%
Software & Computer Services	18,138	16,748	1,865,492	2,374,820	-7.7%	27.3%
Transportation, Warehousing, & Distribution Logistics	29,897	36,933	3,384,696	3,092,953	23.5%	-8.6%
Renewable Energy (Biofuels)	277	1,884	3,254	10,582	580.1%	225.2%

Source: USDOL, BLS, QCEW, 2015; Calculations by NDED, 2015
Note: Employment is from published BLS data, which may not be complete for Nebraska. In the case of incomplete data, US employment for that industry is dropped, to provide consistent results.

In the original Battelle report three of the clusters experienced negative employment growth during the period of the study. During the 2008–2014 period, half of the clusters experienced a loss of employment between the start of the Great Recession and 2014 (Table 2). Extending the time period of the study to 2014 results in only two of the Nebraska industry group experiencing negative employment growth. Except for Precision Metals Manufacturing and Software and Computer Services, all 12 industry groups saw positive employment growth between 2001 and 2014. However, four of the 12 clusters experienced negative employment growth at the national level. Table 4 presents the data needed to update the target assessment for the industry clusters identified in the Battelle report. The time frame for the updated assessment is 2001 through 2014.

Table 4. Nebraska Primary Industry Groups, Target Assessment Update, 2001–2014

	Location Quotient	**Employment Growth Analysis, 2001-2014**			
Target Industry Title	**Degree of Specialization 2014 (LQ)**	**Nebraska Employment Change**	**US Employment Change**	**Competitive Share Gain or Loss, 2001-14 (% Pt. Change vs. US)**	**Target Assessment**
Total Employment	**1.00**	**7.0%**	**5.7%**	**1.3%**	**N/A**
Agricultural Machinery	7.93	14.2%	-0.3%	14.5%	Current Strength
Agriculture & Food Processing	3.33	0.5%	-20.5%	21.0%	Current Strength
Biosciences	0.60	15.7%	80.6%	-64.9%	Emerging Opportunity
Business Management & Administrative Services	1.20	7.7%	12.2%	-4.6%	Retention
Financial Services	1.42	9.9%	0.7%	9.1%	Current Strength
Health Services	0.99	15.5%	28.0%	-12.5%	Emerging Opportunity

Hospitality & Tourism	0.92	3.4%	8.3%	-4.9%	Emerging Opportunity
Precision Metals Manufacturing	1.05	-34.8%	-40.3%	5.5%	Emerging Strength
Research, Development, & Engineering Services	0.52	27.2%	15.2%	12.0%	Emerging Strength
Software & Computer Services	1.04	-7.7%	27.3%	-35.0%	Emerging Opportunity
Transportation, Warehousing, & Distribution Logistics	1.75	23.5%	-8.6%	32.2%	Current Strength
Renewable Energy (Biofuels)	26.15	580.1%	225.2%	354.9%	Current Strength

In the original Battelle report, these five Nebraska industry clusters were identified as current strengths in the target assessment; Biosciences; Financial Services; Precision Metals Manufacturing; Transportation, Warehousing, and Distribution Logistics; and Renewable Energy (Table 1). In the expanded time frame, five clusters are again classified as current strengths, using the same scoring criteria as the 2010 Battelle report, with only Financial Services and Research, Development, and Engineering Services remaining as current strengths. Two industries dropped from current strengths to emerging opportunities; these were Biosciences and Precision Metals Manufacturing. The Business Management and Administrative Services cluster remained a retention target. The Precision Metals Manufacturing cluster dropped from a current strength based on the 2001–2014 data to an emerging strength based on the expanded data, due to a reduction in the location quotient, which now indicates that this cluster is no longer an area of specialization in Nebraska's economy. For the same reason, Software and Computer Services slipped from a retention target to an emerging opportunity.

A Shift-Share Analysis of Nebraska's Targeted Industry Groups

In addition to using location quotients for updating the target assessment of the industry clusters identified in the Battelle report, NDED's Research Division decided to make use of shift-share analysis, another common metric in regional analysis. While Battelle did not appear to make explicit use of this tool, the target assessment in the 2010 report relied on results that are important parts of a shift share analysis.

Shift share is a method of attributing changes in a regional industry's employment level to three components: (1) a national growth component (NS) defined as the share of local employment growth attributed to growth of the national economy); (2) an industrial mix component (IM) defined as the share of local employment growth attributed to growth within that cluster nationally; and (3) a competitive, or regional, share (RS) defined as the local growth rate in the industry cluster relative to the national growth rate in the cluster—the share of local employment growth attributed to unique local factors that have caused growth or decline in a cluster.

In a shift-share analysis, the total change in employment between two periods for an industry is equal to the sum of the three components. The formula for the shift share is $e_i^{t+n} - e_i^t = NS_i + IM_i + RS_i$, where e_i^t is employment for industry *i* at time *t*, and *n* is the number of years in the analysis.

The first component, national growth or national share, shows how much of the regional industry's growth is explained by the overall health of the national economy. The formula for determining the national share is $NS_i =$

$e_i^t \times (G)$, where G is equal to the employment growth rate of the entire national economy for the period of the analysis.

The industrial mix component represents the share of regional industry employment growth that is explained by the growth of the industry at the national level. If a particular industry were growing at a faster rate than the economy as a whole, the industry mix would be greater than the national share component. The formula for determining the industrial mix is $IM_i = e_i^t \times (G_i - G)$, where G_i is equal to the employment growth rate of industry *i* at the national level for the period of the analysis.

The regional share component determines the share of the change in regional employment due to competitive advantages of the region for the industry in question. A regional comparative productive advantage could be due to factors such as higher productivity, local raw materials or inputs, deployment of advanced technologies, better management or market access, human capital advantages, and so on. The formula for determining the industrial mix is $RS_i = e_i^t \times (g_i - G_i)$, where g_i is equal to the employment growth rate of industry *i* at the regional level for the period of the analysis.

A shift-share analysis was performed using the Nebraska industry clusters identified in the Battelle report for the 2001-2014 period. Table 5 presents the results of this analysis along with the location quotients for the beginning and end of the study period.

The regional, or competitive, share is shown in the third column of the shift-share analysis. If the competitive share is positive, it signals that the region has a comparative productive advantage. The number for each industry represents the number of jobs in the region that are due to the comparative advantage. The Nebraska industry clusters with a comparative advantage over the study period include Agricultural Machinery; Agriculture and Food Processing; Financial Services; Precision Metals Manufacturing; Research, Development, and Engineering Services; Transportation, Warehousing, and Distribution Logistics; and Renewable Energy.

The last column under the shift-share subheading is labeled Total Job Growth and represents the total change in employment for each industry over the study period. It also represents the sum of the national share, industry mix, and regional shift. Note that all Nebraska industry groups experienced increased employment between 2001 and 2014, except Precision Metals Manufacturing and Software and Computer Services.

Table 5. Location Quotients and Shift Share Analysis by Targeted Industry Group, 2001–2014

	Location Quotient		Shift-Share Analysis, 2001-2014			
Target Industry Title	**2001**	**2014**	**National Share**	**Industry Mix**	**Regional - Competitive Shift**	**Total Job Growth**
Agricultural Machinery	7.00	7.93	558	(586)	1,419	1,391
Agriculture & Food Processing	2.66	3.33	3,174	(14,552)	11,640	262
Biosciences	0.95	0.60	294	3,853	(3,340)	807
Business Management & Administrative Services	1.26	1.20	2,188	2,487	(1,742)	2,933
Financial Services	1.32	1.42	2,540	(2,219)	4,055	4,376
Health Services	1.11	0.99	2,944	11,477	(6,455)	7,966
Hospitality & Tourism	0.97	0.92	840	385	(723)	503
Precision Metals Manufacturing	0.97	1.05	920	(7,408)	891	(5,597)
Research, Development, & Engineering Services	0.48	0.52	259	428	546	1,233

Software & Computer Services	1.44	1.04	1,038	3,915	(6,342)	(1,390)
Transportation, Warehousing, & Distribution Logistics	1.31	1.75	1,710	(4,287)	9,613	7,036
Renewable Energy (Biofuels)*	12.65	26.15	16	608	983	1,607
Target Industry Totals			**16,482**	**-5,900**	**10,545**	**21,127**

Source: Data from BLS, QCEW, 2015; Calculations by NDED, 2015

*Battelle includes only one sector (ethyl alcohol manufacturing) in this cluster.

The precision metals cluster experienced a significant drop (-7,408) in the industry mix component, which indicates that this cluster had slower growth in Nebraska than these industries had in the rest of the county. Yet at the same time, this cluster appears to have some competitive advantages in Nebraska, because the regional shift component remained positive.

The Software and Computer Services cluster experienced a drop of 6,342 jobs in the regional shift component of the analysis. This indicates a decline in productivity. This could be due to limited market access in Nebraska, or it could be due to a shift between clusters resulting in reduced employment in one cluster and expanding employment in one or more other clusters. One possibility is that employees in software and computer businesses have found their skills in higher demand in financial and business management businesses, or that owners of software and computer businesses have found it advantageous to specialize as support services for particular industries, especially in Financial Services and Business Management & Administrative Services. This could explain why the location quotient for Software and Computer Services dropped, along with employment in this industry.

Table 5 also presents location quotients for each industry cluster, indicating the degree of specialization of the cluster in Nebraska in 2001 and 2014. Comparing the measure for the two dates indicates whether the Nebraska industry cluster has become more or less specialized over time. Five clusters are considered specialized ($LQ \geq 1.2$) in 2001 and have increased their level of specialization during the 14-year study period. These are the Agricultural Machinery; Agriculture and Food Processing; Financial Services; Transportation, Warehousing, and Distribution Logistics; and Renewable Energy clusters. Two industry groups, Precision Metals Manufacturing and Research, Development, and Engineering Services, while not specialized in Nebraska, became more specialized during the study period. Two groups which were specialized in 2001 became less specialized during the study period. The Business Management and Administrative Services cluster had saw its LQ drop from 1.26 to 1.20, but it remains an area of specialization in Nebraska. However, the Software and Computer Services cluster dropped from an initial LQ of 1.44 to 1.04 in 2014, and, while still concentrated, is no longer considered to be an area of specialization in Nebraska. Finally, three industry groups that were not specialized in Nebraska in 2001, Biosciences, Health Services, and Hospitality and Tourism, experienced a reduction in the level of concentration during the study period.

Conclusions

The performance of the targeted industry groups identified in the 2010 Battelle Technology Partnership Practice report, *Growing Jobs, Industries, and Talent: A Competitive Advantage Assessment and Strategy for Nebraska*, was reviewed based on updated data available to the Nebraska Department of Economic Development's Research Division. The primary industry clusters identified by Battelle, for the most part, held up well through the 2008–2014 period. Even in cases where a specific industry or cluster of industries performed poorly since the Battelle report was issued, it would seem premature to suggest changes to the clusters.

First of all, the clusters were defined through a multifaceted process that has not been repeated in this review. There does not appear to be any case where a strong argument can be made to move industries in or out of the current definition of a cluster or to move industries between clusters. Second, even where an argument could be made that a particular cluster does not represent a primary industry, the industries that define that cluster still appear to belong in the same group. For these reasons, the Research Division does not suggest making changes to the Battelle clusters at this time. However, any future revisions to NAICS codes should be reviewed in order to determine whether a new industry is defined or whether an existing industry becomes two or more new industries through the division of a current code into two or more new codes, and to determine which clusters the new industries might belong.

Despite our recommendations for no changes at this time, a case could be made for reviewing the Health Services and Biosciences clusters. Battelle cautioned that the Health Services cluster perhaps did not meet the strict definition of a primary industry cluster, as many of the industries served local markets. These industries are important to local labor markets and the quality of life in their communities; however, many of the industries included in the cluster do not serve large percentages of consumers from outside the state. However, this may change for portions of the Health Services cluster, as defined by Battelle. For example, the University of Nebraska Medical Center (UNMC) announced the building of the Buffett Cancer Center, a $323 million, 575,000-square-foot hospital and research laboratory. This project has the potential for bringing in patients and research funding from outside Nebraska. In addition, UNeMed, the technology transfer arm of UNMC, has been successful in increasing the number of new inventions from 161 in 2000–04, to 404 in 2010–14 [UNeMed, 2014 Annual Report, p. 8]. In addition, UNMC and the University of Nebraska–Omaha announced the launch of the Nebraska Advanced Biomedical Innovation and Discovery Institute, a new partnership that should help put new innovations on the market and help spin out startup businesses [UNMC, January 9, 2015, http://app1.unmc.edu/PublicAffairs/TodaySite/sitefiles/today_full_print.cfm?match=16298]. On the other hand, the Biosciences sector has seen some employment growth during the 2001–2014 period, but appears to have lost some employment due to competitiveness factors, and has seen its location quotients drop between 2001 and 2014. When the Biosciences cluster was specialized in Nebraska, with a LQ of 1.21 for 2008, Battelle made a case for this cluster as a current strength in its targeting analysis. It might seem appropriate to drop Health Services as a targeted industry group in Nebraska and move some of the industries from that cluster that have a stronger claim to being primary industries to the Biosciences cluster. This would include moving some NAICS industries currently included in the Health Services cluster to the Biosciences cluster.

This highlights one of the difficulties with defining industry clusters by industry category—some industry definitions contain businesses that potentially belong in more than one cluster. In this case, the primary activity at the Buffett Cancer Center would most likely continue its classification as a hospital, even though the location will have a heavy research orientation. If the Health Services cluster was dropped and hospitals were rolled into Biosciences, this would result in all hospitals being part of biosciences, which would create a tendency for biosciences in Nebraska to look like it was not specialized in Nebraska. Unfortunately, there is not a feasible way to define industry clusters location by location. There is likely to be a similar problem with University partnerships. The coding of industries will tend to classify government and educational institutions in those categories, rather than in industries that define biosciences. However, it is very likely that the businesses spun out of these facilities and partnerships will be classified in the Biosciences cluster, as the startup businesses are organized. Due to these difficulties, it seems best to retain the current clusters and their definitions at this time.

This does not mean that all of the clusters identified by Battelle deserve to have an equal weight in a targeted industry plan. Should policymakers decide to target particular industries for recruitment or retention, or decide to provide additional incentives to further a desired economic development outcome, differential weights could be identified and applied to the clusters identified in the Battelle report and reviewed in this report. These weights could be used in a qualification test, where a scoring rule is developed for determining qualification or level of assistance in an economic development incentive plan.

Battelle 2010 Appendix A: Primary Industry Cluster Defined by Industry

NAICS Code	NAICS Title/Description
Cluster:	**Agricultural Machinery**
33311	Agricultural Implement Manufacturing
333241/294	Food Product Machinery Manufacturing
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers
Cluster:	**Agriculture & Food Processing**
111	Crop Production
112	Animal Production
1151	Support Activities for Crop Production
1152	Support Activities for Animal Production
3222	Converted Paper Product Manufacturing
4245	Farm Product Raw Material Merchant Wholesalers
32611	Plastics Packaging Materials and Unlamented Film and Sheet Manufacturing
32616	Plastics Bottle Manufacturing
33243	Metal Can Box and Other Metal Container (Light Gauge) Manufacturing
42441	General Line Grocery Merchant Wholesalers
42491	Farm Supplies Merchant Wholesalers
311111	Dog and Cat Food Manufacturing
311119	Other Animal Food Manufacturing
311211	Flour Milling
311212	Rice Milling
311213	Malt Manufacturing
311225	Fats and Oils Refining and Blending
311230	Breakfast Cereal Manufacturing
311311	Sugarcane Mills
311312	Cane Sugar Refining
311313	Beet Sugar Manufacturing
311320	Chocolate and Confectionery Manufacturing from Cacao Beans
311330	Confectionery Manufacturing from Purchased Chocolate
311340	Nonchocolate Confectionery Manufacturing
311411	Frozen Fruit Juice & Vegetable Manufacturing
311412	Frozen Specialty Food Manufacturing
311421	Fruit and Vegetable Canning
311422	Specialty Canning
311423	Dried and Dehydrated Food Manufacturing
311511	Fluid Milk Manufacturing
311512	Creamery Butter Manufacturing
311513	Cheese Manufacturing
311514	Dry Condensed and Evaporated Dairy Product Manufacturing
311520	Ice Cream and Frozen Dessert Manufacturing
311611	Animal (except Poultry) Slaughtering
311612	Meat Processed from Carcasses
311613	Rendering and Meat Byproduct Processing
311615	Poultry Processing
311711	Seafood Canning
311712	Fresh and Frozen Seafood Processing

311811	Retail Bakeries
311812	Commercial Bakeries
311813	Frozen Cakes Pies and Other Pastries Manufacturing
311821	Cookie and Cracker Manufacturing
311822	Flour Mixes and Dough Manufacturing from Purchased Flour
311823	Dry Pasta Manufacturing
311830	Tortilla Manufacturing
311911	Roasted Nuts and Peanut Butter Manufacturing
311919	Other Snack Food Manufacturing
311920	Coffee and Tea Manufacturing
311930	Flavoring Syrup and Concentrate Manufacturing
311941	Mayonnaise Dressing and Other Prepared Sauce Manufacturing
311942	Spice and Extract Manufacturing
311991	Perishable Prepared Food Manufacturing
311999	All Other Miscellaneous Food Manufacturing
326199	All Other Plastics Product Manufacturing
327213	Glass Container Manufacturing
333993	Packaging Machinery Manufacturing
541940	Veterinary Services

Cluster:	**Biosciences**
311221	Wet Corn Milling
311222	Soybean Processing
311223	Other Oilseed Processing
325193	**Ethyl Alcohol Manufacturing
325199	All Other Basic Organic Chemical Manufacturing
325221	Cellulosic Organic Fiber Manufacturing
325311	Nitrogenous Fertilizer Manufacturing
325312	Phosphatic Fertilizer Manufacturing
325314	Fertilizer (Mixing Only) Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing
325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In Vitro Diagnostic Substance Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliance and Supplies Manufacturing
339114	Dental Equipment and Supplies Manufacturing
339115	Ophthalmic Goods Manufacturing
339116	Dental Laboratories
541380	*Testing Laboratories
541711	Research and Development in Biotechnology
621511	Medical Laboratories
621512	Diagnostic Imaging Centers

Cluster:	Business Management & Administrative Services
5418	Advertising Public Relations and Related Services
55111	Management of Companies and Enterprises
56141	Document Preparation Services
56142	Telephone Call Centers
56143	Business Service Centers
56144	Collection Agencies
56145	Credit Bureaus
56149	Other Business Support Services
511140	Directory and Mailing List Publishers
541110	Offices of Lawyers
541120	Offices of Notaries
541191	Title Abstract and Settlement Offices
541199	All Other Legal Services
541430	Graphic Design Services
541613	Marketing Consulting Services
541910	Marketing Research and Public Opinion Polling
561110	Office Administrative Services
561210	Facilities Support Services

Cluster:	Financial Services
521110	Monetary Authorities Central Bank
522110	Commercial Banking
522120	Savings Institutions
522130	Credit Unions
522190	Other Depository Credit Intermediation
522210	Credit Card Issuing
522220	Sales Financing
522291	Consumer Lending
522292	Real Estate Credit
522293	International Trade Financing
522294	Secondary Market Financing
522298	All Other Nondepository Credit Intermediation
522310	Mortgage and Nonmortgage Loan Brokers
522320	Financial Transactions Processing Reserve & Clearinghouse Activities
522390	Other Activities Related to Credit Intermediation
523110	Investment Banking and Securities Dealing
523120	Securities Brokerage
523130	Commodity Contracts Dealing
523140	Commodity Contracts Brokerage+B112
523210	Securities and Commodity Exchanges
523910	Miscellaneous Intermediation
523920	Portfolio Management
523930	Investment Advice
523991	Trust Fiduciary and Custody Activities
523999	Miscellaneous Financial Investment Activities
524113	Direct Life Insurance Carriers
524114	Direct Health and Medical Insurance Carriers

524126	Direct Property and Casualty Insurance Carriers
524127	Direct Title Insurance Carriers
524128	Other Direct Insurance (except Life Health and Medical) Carriers
524130	Reinsurance Carriers
524210	Insurance Agencies and Brokerages
524291	Claims Adjusting
524292	Third Party Administration of Insurance and Pension Funds
524298	All Other Insurance Related Activities
525110	Pension Funds
525120	Health and Welfare Funds
525190	Other Insurance Funds
525910	Open-End Investment Funds
525920	Trusts Estates and Agency Accounts
525990	Other Financial Vehicles

Cluster:	**Health Services**
621410	Family Planning Centers
621420	Outpatient Mental Health and Substance Abuse Centers
621491	HMO Medical Centers
621492	Kidney Dialysis Centers
621493	Freestanding Ambulatory Surgical and Emergency Centers
621498	All Other Outpatient Care Centers
621610	Home Health Care Services
621910	Ambulance Services
621991	Blood and Organ Banks
621999	All Other Miscellaneous Ambulatory Health Care Services
622110	General Medical and Surgical Hospitals
622210	Psychiatric and Substance Abuse Hospitals
622310	Specialty (except Psychiatric and Substance Abuse) Hospitals
623110	Nursing Care Facilities
623210	Residential Mental Retardation Facilities
623220	Residential Mental Health and Substance Abuse Facilities

Cluster:	**Hospitality & Tourism**
487110	Scenic and Sightseeing Transportation Land
487210	Scenic and Sightseeing Transportation Water
487990	Scenic and Sightseeing Transportation Other
561510	Travel Agencies
561520	Tour Operators
561591	Convention and Visitors Bureaus
561599	All Other Travel Arrangement and Reservation Services
561920	Convention and Trade Show Organizers
712110	Museums
712120	Historical Sites
712130	Zoos and Botanical Gardens
712190	Nature Parks and Other Similar Institutions
713110	Amusement and Theme Parks
713120	Amusement Arcades

713210	Casinos (except Casino Hotels)
713290	Other Gambling Industries
713910	Golf Courses and Country Clubs
721110	Hotels (except Casino Hotels) and Motels
721120	Casino Hotels
721191	Bed and Breakfast Inns
721199	All Other Traveler Accommodation

Cluster:	Precision Metals Manufacturing
3323	Architectural and Structural Metals Manufacturing
3327	Machine Shops; Turned Product; and Screw Nut & Bolt Mnfg
3328	Coating, Engraving, Heat Treating
3329	Other Fabricated Metal Product Manufacturing
3335	Metalworking Machinery Manufacturing
3362	Motor Vehicle Body and Trailer Manufacturing
3363	Motor Vehicle Parts Manufacturing
3369	Other Transportation Equipment Manufacturing

Cluster:	Research Development & Engineering Services
541330	Engineering Services
541380	Testing Laboratories *
541710	Research and Development in the Physical, Engineering, and Life Sciences *
541712	*Research & Development in the Physical Engineering & Life Sciences (except Biotech)

Cluster:	Software & Computer Services
511210	Software Publishers
518210	Data Processing, Hosting, & Related Services
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services

Cluster:	Transportation Warehousing and Distribution Logistics
33392	Material Handling Equipment Manufacturing
481111	Scheduled Passenger Air Transportation
481112	Scheduled Freight Air Transportation
481211	Nonscheduled Chartered Passenger Air Transportation
481212	Nonscheduled Chartered Freight Air Transportation
481219	Other Nonscheduled Air Transportation
482111	Line-Haul Railroads
482112	Short Line Railroads
483111	Deep Sea Freight Transportation
483112	Deep Sea Passenger Transportation
483113	Coastal and Great Lakes Freight Transportation
483114	Coastal and Great Lakes Passenger Transportation
483211	Inland Water Freight Transportation
483212	Inland Water Passenger Transportation

484110	General Freight Trucking Local
484121	General Freight Trucking Long Distance Truckload
484122	General Freight Trucking Long Distance Less than Truckload
484220	Specialized Freight (except Used Goods) Trucking Local
484230	Specialized Freight (except Used Goods) Trucking Long Distance
488111	Air Traffic Control
488119	Other Airport Operations
488190	Other Support Activities for Air Transportation
488210	Support Activities for Rail Transportation
488310	Port and Harbor Operations
488320	Marine Cargo Handling
488330	Navigational Services to Shipping
488390	Other Support Activities for Water Transportation
488490	Other Support Activities for Road Transportation
488510	Freight Transportation Arrangement
488991	Packing and Crating
488999	All Other Support Activities for Transportation
492110	Couriers and Express Delivery Services
493110	General Warehousing and Storage
493120	Refrigerated Warehousing and Storage
493130	Farm Product Warehousing and Storage
493190	Other Warehousing and Storage

Cluster:	**Renewable Energy**
325193	Ethyl Alcohol Manufacturing